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Barriers to Technology Transfer in Kenya: The Role of Extension

by

Samuel Cheruiyot Sinei

A PAPER

SUBMITTED TO THE DEPARTMENT OF RURAL ECONOMY

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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DEPARTMENT OF RURAL ECONOMY

The undersigned certify that they have read, and recommend to the Department of Rural Economy, for acceptance, a paper entitled Barriers to Technology Transfer in Kenya: The Role of Extension submitted by Samuel Cheruiyot Sinei in partial fulfilment of the requirements for the degree of Master of Agriculture.

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Supervisor

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Date July 23, 1987

Abstract

The process of technology transfer requires a deep understanding of associated barriers, yet most programs and policies in developing countries only give lip service to the investigation into the intensity of these obstacles. The success of technological change in agriculture can only come about through dissemination, adoption and diffusion of knowledge and skills in farming communities. The future hope of adequate food production requires complete understanding of existing economic, educational, social, cultural, communication and psychological constraints and efforts to overcome them.

In Kenya, extension is the major means of technology transfer to rural farm families. Literature review, however, reveals deficiencies in consideration of the barriers to technology transfer and the choice of extension methods used. Extension program planning and development is an integral part of extension science involving: several planning stages and program action. Cyclical phases of planning include: situational analysis, identification of farmers' needs, determining problem and resources, coordination with other service agencies and planning teaching and learning experiences. Program action involves implementation, monitoring, and evaluation through follow up.

For the above cyclical stages to succeed in Kenya, concerted effort is necessary to strengthen linkages between agricultural researchers, extension agents and the farm families. In addition, extension policy programs should be formulated on the basis of research data about the rural community and farm family.

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Chapter I

The Problem and Its Setting

A. Introduction

Production of adequate food supplies to meet the needs of accelerating population growth in most less developed countries, is one of the major issues in development. As these countries strive to meet this need, agricultural transformation through technological change is of paramount importance. To be of any use, agricultural technology once developed by researchers, must be transferred, and used by the farming communities. During the transfer process, technical and socio-economic problems are usually encountered. The purpose of this project, therefore, is to examine some of the factors associated with technology transfer to rural farm families in Kenya.

B. Background to the Problem

Kenya is located between latitudes 4 degrees 21 North and 4 degrees 28 South and between longitudes 34 degrees and 4 East. It is a medium sized African state with an area of about 580,367 square kilometers. Its land surface is approximately 569,137 square kilometers and it has a total water surface of about 11,230 square kilometers (Ominde, 1984, p. 1). After the Berlin Conference held in 1885, the native land of Kenya became part of British East Africa territories. On June 23, 1920, it became a British colony. Independence was obtained on December 12, 1963. Trade with the outside world in the pre-colonial era was almost non- existent. The natives were living in a basic subsistence economy. The subsistence nature of agricultural production, however, changed with the arrival of European settlers, who, after taking the best land from indigenous people, undertook to produce export crops. During this period, though economic transformation was positive, it was uneven and oriented towards European settlers. Europeans and Asians benefitted from the economy since they had priority on production and exchange. The lack of growth of the African economy was partly due to the reluctance to accept new ideas, and partly due to various restrictions imposed by

the colonial government. Africans, for example, were not allowed to grow export crops such as coffee and tea.

Agro-Ecological Zones

Geographical studies show that Kenya has a diversified climatic and physical environment. Its landscape reflects both modern and traditional systems of land use. The traditional pattern covers the greater portion of the country where a larger percentage of the population resides (Ominde, 1984, p. 1). Agricultural production, therefore, is as diverse as the prevailing ecological zones.

Land use potential can be classified into ecological zones derived from the combination of climate, soil types, topography and vegetation (Senga, 1976, p. 69). It is important to note at this point that zone delineations in Kenya vary slightly depending on the objective of a given program or study. Range classification, for example, may differ slightly from the description given below.

Senga (1976, p. 71) points out that the data on ecological land units are limited in Kenya. He therefore refers to the classification of land potential in Kenya devised in 1966 by Pratt, Greenway and Gwyne. In this classification, six broad ecological zones were categorized using some important indicator species to delineate zone boundaries. The zones are as follows:

Zone I: Land areas which are mostly barren with the exception of scattered moorland or grassland and vegetation. The area is of limited agricultural use.

Zone II: This zone has a high potential agricultural development. It is estimated to be about 9 percent of the total land area of Kenya. The vegetation is mainly forest. The agricultural potential of this zone is remarkably high with tea, coffee, pyrethrum and other highland crops and livestock production systems predominating. Intensive livestock production on leys is a common feature in this zone.

Zone III: This zone is considered to be of medium agricultural potential. Most of the large scale mixed farming practices are in this portion. Grains, pulses and livestock do very well in the area.

Zone IV: This zone has marginal agricultural potential. Subsistence crop farming and livestock keeping are important occupations in this area. These areas border Kenya game reserves.

Zone V: Zone V is an area of moderate range land. Although wildlife presence is a problem, the area has been the focus of livestock development programs through the animal production branch of the Ministry of Agriculture and Livestock Development.

Zone VI: This zone comprises most of the dry northern part of Kenya. Rainfall is sparse. Vegetation is annual grass species which spring up quickly after rain. Livestock is kept by nomadic pastoral people.

C. Agricultural Development in Kenya: Historical Perspective

Kenya's agricultural development policies and programs are complex. Policies and programs initiated in pre-independent days were carried forward to the post-independent era. Smith (1976, p. 111) distinguishes five chronological agricultural development periods:

1. From the turn of the century to early 1930's.
2. Conservation Era: 1930's.
3. The 1940's and 50's.
4. Independence period.
5. Post independence period.

From the Turn of the Century to Early 1930's

During this period, agricultural policy in Kenya was European settler oriented. In about 1905, Britain agreed to give settlers in Kenya exclusive rights to the ownership of about 20 percent of the best arable land, leaving only about 10 percent to Africans. This eventually resulted in increased population pressure in African reserves, leading to out-migration of labour to European farms. High population density led to land depletion and soil erosion problems. Crop production systems at this time were labour intensive giving rise to squatter systems at very low wages for farm labour. The Europeans heightened their protection by

prohibiting Africans from producing special export crops such as coffee. In addition, the settlers interfered with livestock farming by blocking livestock market outlets for the Africans. Control over research and advisory services created a monopoly such that the staff of the Department of Agriculture did not extend their efforts to African farmers until 1923. Though during this period, local people were responsive, their development was drastically retarded. The Europeans further controlled fiscal, transportation and freight rates policies. Most of the policy innovations such as price policy manipulations, provision of agricultural credit and subsidies were biased towards large scale farmers, practices which became common feature for a time in Kenya after independence.

The Conservation Era: 1930's

The colonial government for the first time took notice of the increasing African population pressure on land and accelerating soil erosion problems. Attempts to conserve the soil were made but were limited in scope. These measures were based on rotational grazing and cultivation. The effectiveness of such steps were weakened by improper planning and failure to implement programs.

The 1940's and 1950's

The world depression of the 1930's hurt European farmers in Kenya. Further, food demand during the Second World War required increased food production to feed soldiers and war prisoners. To stimulate production, farm credit was introduced through crops ordinance with short term credit under guaranteed minimum returns. Previous restrictions on special crops such as coffee were lifted to allow African farmers to produce the commodities. By 1951, Africans were producing coffee.

The extension approach was selective. A few well selected peasants were given instructions and advice through individual farm visits. The Swynnerton plan of 1954 was a turning point in Kenya's agricultural history.

The Swynnerton plan of 1954 was the beginning of the economic transformation in Kenya (Ikiara, 1981, p. 21). Ikiara gives a synopsis of the plan. The plan's objective was to make people more productive in order to raise their living standards. Ikiara points out clearly that the objectives of the Swynnerton plan are strikingly similar to the objectives of Kenya's development plans since independence. The Swynnerton plan acknowledged the advantage of a sound foundation of agriculture through: soil conservation; livestock improvement; conservation of water supplies; investigation and experimentation into proper farming methods for cash crops and; methods of cultivation and pasture research (Smith, 1976, p. 125). Swynnerton proposed that plans be drawn according to ecological and rainfall settings. The basic philosophy of the Swynnerton plan had the following underlying principles:

1. Sound agricultural development is dependent upon a land tenure system which makes a unit of land available to an African family and whose production can support the household.

2. Consolidation and registration of land holdings were to be the necessary preconditions for development.

3. Extension service would plan intensified development of the land through correct farm layout, conservation measures, crop and livestock improvement.

4. As far as research was concerned, Swynnerton's philosophy was that: in theory agricultural development should not precede investigation into systems of farming which it is desired to practice.

5. Swynnerton argued that African farmers would require access to agricultural credit.

6. The plan introduced commodity marketing boards, such as provincial boards for control of maize production and marketing.

Independence Period

At independence, European farms still provided about three quarters of Kenya's agricultural exports. The first post- independence development plan proposed that production in large scale farms be maintained. Plans, however, were made to transfer land from

European settlers to Africans. Some of the large farms would be subdivided into small holdings to alleviate population pressure in adjacent African reserves. The key objective after independence was to direct a large proportion of development resources to areas previously neglected. Agricultural programs were therefore aimed at:

1. The intensification of land use for crop and livestock production.
2. Land redistribution towards more labour intensive farm units.
3. Settlement of unused and under-utilized agricultural land.

Post Independence Period

The achievement of independence was a turning point in political and economic history in Kenya. New leaders made both political and economic decisions to enhance economic progress. The economy, however, is characterized by numerous and variable socio-economic problems similar to those found in many less developed nations. Soon after independence, strategies and goals were laid down to transfer economic power to citizens by removal of racial discrimination and creation of equal economic opportunities for all.

Progress in Agriculture

Between 1964 and 1981, agricultural growth in Kenya contributed about 3.7 percent growth of real Gross Domestic Product (GDP), 4.7 percent between 1964 and 1972 and 1.9 percent between 1972 and 1981 (Developmental Plan, Kenya, 1984/88). These figures are at constant 1976 prices.

Specifically, the GDP growth rates from 1972 to 1981 were as follows:

Period	GDP	Period	GDP
1972 - 73	+3.3	1977 - 78	+4.8
1973 - 74	+0.6	1978 - 79	-0.9
1974 - 75	+3.4	1979 - 80	-1.3
1975 - 76	+1.9	1980 - 81	+6.3
1976 - 77	+9.1		

In 1974, drought affected agricultural production causing such a fall in GDP growth. The sluggish growth in 1978 to 1980 was due to falling coffee prices while 1979 to 1980 was again affected by drought. As shown by the figures, the recovery started in 1981.

D. The Nature and Significance of the Problem

Since Kenya's economy is predominantly agricultural, the majority of the people earn their living from basic subsistence agriculture. Land fragmentation and population growth cause small farms to become even smaller. Food demand by the accelerating population cannot be met by continuing use of traditional agricultural practices. By the end of this century, Kenya will have a population of about 35 million (Sessional Paper No. 1, 1986, Kenya). For this population to obtain even their basic living from agriculture, the country must modernize subsistence farming by use of improved technology. Since the production structure is different for small holders and large scale farmers, the strategies must be specific to particular situations and geographic areas.

To alleviate this situation, Kenya Government has persistently drawn development plans with emphasis on primary production for agriculture. This is necessary in order to meet domestic food demand while export farm commodities are being taken into consideration. Various agricultural institutions have been created to serve farmers in Kenya. Research and extension play important roles in modernization of agriculture.

Research findings in Kenya, in addition to technologies found elsewhere, are available for transfer. But availability of innovation is not in itself an answer to the food problem. The technologies must be transferred to farmers and utilized. This study examines factors related to the transfer of technology.

E. The Objectives of the Study

The broad objective of the study is to carry out an examination of the barriers associated with technology transfer in general and with specific reference to Kenya. The role of extension education in the technology transfer process will be examined in broad

perspective and in its application to Kenya.

More specifically, the objectives of the project are:

1. To identify and determine barriers associated with technology transfer.

2. To examine extension education as it relates to technology transfer.

3. To suggest and make some recommendations designed to facilitate technology transfer in Kenya.

Assumptions

The study is based on the following general assumptions:

1. Appropriate technology can be obtained for transfer to Kenyan farmers.

2. Identification of barriers associated with technology transfer will enable extension agents to improve their strategies to disseminate scientific knowledge to farmers.

F. Organization of the Project

This project is discussed under five chapters. The first chapter outlines the problem and its setting by covering the following areas: the background on Kenya, its ecological zones, Kenya and agricultural development history from pre-colonial era to the present. The historical perspective is given in chronological order and in each period, major events are mentioned where applicable. The chapter highlights the nature and significance of the problem, the objectives of the study, assumptions and the organization of the study. Chapter two gives a selected literature review on barriers associated with agricultural technology transfer. The definition of technology and its transfer is given plus innovation diffusion literature in brief. Literature on selected barriers associated with technology transfer is discussed under the following subheadings: economic, educational, social, cultural, communication and psychological. Chapter three discusses principles of extension and technology transfer. The presentation covers definition, philosophy of extension, extension methods, program planning, evaluation and extension service in Kenya. The fourth chapter deals with barriers to technology transfer in Kenya and briefly touches on government policy

programs and objectives related to agricultural development. The summary and recommendations are presented in chapter five followed at the end of the project by a list of selected references.

Chapter II

Literature Review

A. Introduction

The tendency to emphasize technology transfer in agriculture as a step towards increasing agricultural productivity in third world nations is not new. Recent assessments, however, on resource transfer indicate that the rate of adoption can be retarded severely by numerous inter-related socio-economic barriers, prevalent in the recipient countries. In any given country, there are societal, community, individual and institutional factors which can affect the implementation of projects. This does not mean that innovation adoption is non existent. General observations, for example, of biochemical transfer, show that it can increase production but is skewed towards large and more prosperous farmers. However, large proportions of the populations of developing countries are rural with agriculture as their main occupation. This group own the land and till it. Poverty, alienation and hunger characterize much of this group. Major problems exist for these people in terms of improving their agricultural practices through technology transfer.

Brady (1986) mentions that although the present economic situation of developing countries is unacceptable, and the demands by the growing world citizenry for food exceeds the capacity of many of the nations of the developing world, overall, there is optimism for improvement in food security. Brady further remarks that, progress to a limited extent has been achieved and potential plans for further progress are in evidence. Due to the adoption and application of improved technologies, practices and policies, the world's farmers produced twice as much food in 1980 as they did in 1950.

Barriers to technology transfer in developing countries such as Kenya exist. The purpose of this literature review therefore is to present and discuss selected barriers to technological transfer. The review of literature on technology transfer constraints is basic and applicable to third world countries.

B. The Concept of Technology and its Transfer

Technology

Webster's Ninth New Collegiate Dictionary gives a number of definitions of the term technology. Two of these are closely related to the topic in question: a scientific method of achieving a practical purpose; the totality of the means employed to provide objects necessary for human sustenance and comfort. Agricultural research has developed technologies that effect the types and means of food production (Gilson, 1964). Gilson (1964) identifies two types of agricultural research: (1) Research directed at increased physical production which he refers to as "output-increasing" research, and (2) research directed at substituting capital for labour in farm production. He calls this "labour-saving research."

Hayami and Ruttan (1984, page 74) suggest that:

> It seems reasonable, according to the definition of John R. Hicks, to call techniques designed to facilitate the substitution of other inputs for labour "labour saving" and ones designed to facilitate the substitution of other inputs for land "land saving". In agriculture, mechanical technology is to labour saving as biochemical technology is to land saving.

Technology Transfer

Technology transfer is a multi-faceted phrase. Rogers and Burge (1972, page 349) describe this as a process by which technological innovations are communicated, and how farmers make decisions to adapt these ideas. Brady (1986, p. 10) indicates that the transfer of technology to developing countries, involves the transfer not only of information but also of skill, and hopefully in ways that encourage the development of indigenous skills.

The process of technology transfer is very complex. Hayami and Ruttan (1984, p. 260) distinguish three phases of technology transfer:

1. Material transfer: This phase is characterized by simple transfer of new materials, such as seeds, plants, animals, machines and techniques associated with them.

2. Design transfer: In this phase, the transfer of technology is primarily through the transfer of certain designs to be tested and applied in new environments.

3. Capacity transfer: This phase involves the transfer of scientific knowledge and capacity to enable the production of locally adaptable technology. An important element associated with this category is migration of scientists from developed countries to assist in local situations in less developed nations.

C. Factors Associated with Agricultural Technology Transfer

The complex processes by which technologies are transferred and diffused from scientists or other developed sources to farmers are associated with certain factors. Among many are the innovation decision process itself and the characteristics of adopters.

The Innovation Decision Process

The innovation decision process is a mental process through which an individual passes from first knowledge of an innovation, to a decision to adopt or reject, and to later confirmation of this decision (Rogers and Burge, 1972, p. 355). This process takes place in stages with a time dimension.

Rogers (1960, p. 402) briefly outlines the four conventional stages:

1. Awareness: At this stage, the individual is exposed to an idea but lacks detailed information about it.

2. Interest or Information: At this stage, the individual is motivated to find out more about this idea. He seeks more information to help him relate the new idea to his past experiences.

3. Evaluation or Application: Here the potential adopter of an innovation goes through a mental trial in applying the idea to his situation. The individual considers the relative advantage of the new practice over alternatives before deciding whether to try it or not.

4. Trial: If the mental trial is favorable, the individual will try to apply the new idea to his particular farming situation.

The Nature of Adopters

Farmers do not adopt a new technology at the same time. Adopters can be placed on an early-late continuum of adoption (Rogers, 1960, p. 409). Often, the phrase "adopter categories" is used. This is a classification of members of a social system on the basis of innovativeness (Rogers and Burge, 1972, p. 356). The potential adopters fall into five categories:

1. Innovators: These are the first farmers to adopt a new agricultural idea. They are experimenters. Two important qualifications to be an innovator are: (1) control of substantial financial resources, (2) the ability to understand and apply a new technical knowledge. Some of the characteristics of innovators include: high income, high level of education in a relative context and a high social status.

2. Early Adopters: These are well integrated members of the local social system. The group works on the philosophy that it is best not to be the first to try a new practice nor the last to brush aside old ideas. Compared to the average farmer, they have slightly higher education. In addition they are younger and participate to a greater extent in formal organizations.

3. Early Majority: This category adopts new technology just before the average members of the social system. They display deliberate willingness in adopting innovations. Their education, ability to read, participation in formal organizations and contact with change agents are slightly higher than that of the average farmer.

4. Late Majority: This adopter category responds to increasing social and economic pressures. They are convinced when the weight of community opinion definitely favors the new idea.

5. Laggards: These are the last to adopt a new technology. They live as isolates. Their older age and tradition slows down the innovation decision process. This category is composed of individuals with lower education and income levels than others in their communities.

The Trickle-Down Process

Any study of extension process that does not take into consideration this classic corollary of how ideas are diffused is incomplete. Rogers (1960, p. 328) describes the trickle-down theory as the process by which: adoption leaders or influential farmers come in direct contact with new technologies. Their neighbors see the new technologies as they are applied by adoption leaders. Studies confirm that the trickle-down process is a special case of two step flow of communication. The indirect contact phenomena from farmer to other farmers through adoption leaders is, however, difficult to measure since it involves word of mouth communication. Rogers (1960, p. 418) further points out that research studies have indicated that new farm ideas often do not trickle down all the way to the low income laggards. He further indicates that social status differences are seldom a barrier to the diffusion of new ideas from adoption leaders to laggards, but social status does tend to slow up the flow of the new farm information.

D. Barriers to Technology Transfer

An understanding of the complexity of the process of adoption and diffusion of innovations is not enough to design strategies for technology transfer to and within third world rural communities. Many socio-economic barriers exist.

Problems of rural development are numerous. Because of the complexity of such problems, the role of extension impinges on the whole economic and social fabric of the rural community. Social values and existing social institutions such as marketing methods, land tenure and farm credit facilities establish a social structure within which technology transfer occurs. The complexity of technology transfer for rural development results from a number of influencing factors related to the target community, the technology itself and prevailing external forces. Before any extension project is undertaken, the following important questions should be answered:

1. Who is the target group that appears to have the need for the technology?

2. Has the target group requested a solution or technology for their need? Do they see their need?

3. Was the target group involved in the design or development of technology?

4. Is the applied technology viable to the target audience?

A case study done by Agriculture Canada in 1986 found that the rate of agricultural technology transfer is influenced to a significant degree by:

1. The complexity of the technology.

2. The financial and physical resources required for adoption.

3. The time frame and nature of economic returns to primary producers.

4. The accepted agricultural norms of the community.

The study concluded that the success or failure of agricultural technology transfer cannot be determined if the rate of technology transfer and the ultimate percentage of the primary producers who can economically utilize the innovations have not been determined.

Many factors exist which have the potential to act as barriers to technology transfer. Economic, educational, social, cultural, communication and psychological factors have been identified as factors related to technology transfer.

Economic

It is now generally accepted that farmers the world over respond to product and factor prices in agricultural production systems. Price distortions affect the speed of technology transfer and the decision to adopt and use a given agricultural innovation. In addition, the speed with which a new idea is adopted depends partly upon the characteristics and nature of the idea. Rogers (1960, p. 403) uses cost as an economic factor affecting the rate of adoption of new ideas. Rogers points out that new practices that are high in cost tend to be adopted more slowly. Benefits relative to cost that a farmer associates with a new practice may also be related to his adoption decision.

General Distortions

Distortions of agricultural development resulting from government prohibitions have been pointed out by various writers. Hopper (1978) points out that interventions by governments to prevent or penalize the use of particular inputs can be direct or indirect. Direct intervention involves banning, for example, the use of a chemical without analyzing cost benefit in agriculture.

Indirect policies of governments can depress agricultural output and slow rural progress. Distortions of product prices downwards and factor prices upwards reduce incentives to increase production and restrict adoption of new technology. Other examples of indirect intervention are import tariffs on technological equipment, and inefficient diversion of resources to non-agricultural uses. Hopper (1978) concludes that all prohibitions are direct constraints on production; and reduce opportunities for adoption of technological innovations.

Increased agricultural production requires positive incentives and positive response on the part of the farmers to those incentives (Mellor, 1966, p. 244). Wyeth (1981) mentions that no innovation will be taken up if farming is not profitable, hence pricing and marketing are important factors to consider.

Institutional innovations that permit firms and institutions to internalize the benefits of innovative activity become particularly important in creating the incentives for both innovative and productive behaviors (Hayami and Ruttan, 1984).

Incentives

An incentive is something that incites or has tendency to incite to determination or action. It is that which stimulates or sets the tune (Webster's Dictionary). For agricultural innovations, T. W. Shultz (1978) asserts that what is needed are many Green Revolutions that would increase agricultural production throughout low income countries. However, these revolutions are suppressed by the lack of adequate incentives. There are two main views relating to incentive literature as used here:

1. The incentives to which farmers respond.

2. The optimum economic incentive.

The incentive to which farmers respond consists of economic information that farmers use in calculating their expected costs (Shultz, 1978). This includes risk against the returns they expect to receive. In this context, an incentive is the product of economic information from which the farmer derives his expectations and the decision to accept the technology being transferred to him.

Optimum economic incentive provides the information that leads producers to allocate resources in ways that result in maximum production which will clear the market, at the price that maximizes the utility of the consumers (Shultz, 1978). However, governments often alter competitive market incentives. Thus, for want of profitable incentives, farmers are not making the necessary investments including the purchase of superior inputs and services to facilitate technology adoption.

Production

Progress in scientific research oriented to agricultural production in developing countries has been remarkable in recent years but there have been constraints in the application of the same. Shultz (1978) says that the utilization of these findings are often diluted by distortions of producer incentives. This bad state of distortions further causes misallocation of capital received from international donor countries. The chain of actions and interactions to improve the incentive is long and complex. Shultz et al suggests actions to include:

1. Activities of agricultural research enterprises.

2. Responses of farmers in adopting the worthwhile output of that research.

3. The price of capital and its efficient allocation in increasing the physical and biological capacity of agriculture.

4. The quality of the stock of human capital.

5. Efficient markets for agricultural products and for inputs that farmers purchase.

6. Use of public funds to subsidize the food grains.

Shultz et al comments that whenever farm products are underpriced and though superior varieties are at hand, adoption is only partial. Distortions of incentives tend to misguide agricultural research.

Pricing

Brown (1978) suggests that higher prices may stimulate agricultural production by:

1. Causing producers to move closer to their production possibility frontier.

2. Encouraging more use of variable resource inputs to reach higher production function.

3. Inducing investment discovery and adoption of new agricultural technologies. Brown (1978) further says that clear links have been demonstrated between pricing policy, the discovery and nature of new agricultural technology and the adoption and use of the techniques by farmers. Studies of innovation diffusion and investment in developing countries indicate that where profitability of adopting a new technology is high, new techniques will be rapidly picked.

Price and production control nominally intended to provide low cost food to urban poor tend to divert production away from those commodities (Brown, 1978). This author suggests that marketing controls frequently have very adverse effects on efficiency, production and income distribution. Such dissatisfaction would usually lead to alienation from new technology even if it is appropriate for local situations.

Lele (1984) in referring to rural Africa points out that peasant agriculture is highly taxed by fixing low prices for its products and by over-valuing the national currencies. Traditionally, peasants were taxed because they were perceived as irrational, lazy and unresponsive to price incentives. This is because relative prices are easier for governments to influence than technology adoption or qualities of services.

Marketing

Lele (1984) mentions that input and output marketing and processing facilities are almost always operated by semi- autonomous government agencies or by largely government initiated cooperatives on a monopoly basis. Such public marketing agencies tend to be high cost operations because of overstaffing, poor financial control, accountability and inexperienced management. In most developing economies, the market systems remain relatively underdeveloped. So a major challenge facing these countries in their planning is the development of a well articulated market system capable of accurately reflecting the effects of changes in supply, demand and production relationships (Hayami and Ruttan, 1984). An important element, therefore, in the development of a more efficient factor and product market system is the removal of the rigidities and distortions resulting from government policy itself e.g. unfavorable factor and product price policies.

Resource Allocation

Collinson (1987) mentions that useful technologies for farmers in Eastern and Southern Africa take account of their low resource base. Their over-riding need for starch staples plays a dominant role in resource allocation. Farmers often over-commit resources to food production to protect against a worse than average year. Increased stability in starch staples would remove the need for food insurance and allow farmers to allocate scarce land resources to meet market needs. One way to do this is to encourage change in starchy staples. When the right incentives are there, small farmers will change their food consumption patterns.

Educational

Education imparts specific knowledge and develops general reasoning skills. It induces changes in beliefs, values and attitudes towards work and society (World Development Report, 1980, p. 47). Education promotes the understanding of complex innovations. Rogers and Burge (1972, p. 353) define complexity as the degree to which an innovation is perceived

as difficult to understand and use. Some innovations are readily understood by most members of a social system; others are more complex and will be adopted more slowly. In general, new ideas requiring little additional learning on the part of the adopter will be adopted more rapidly than complex innovations needing the development of new skills.

Todaro (1981, p. 298) remarks that most economists would probably agree that it is the "human resources" of a nation, not its capital nor its material resources, that ultimately determine the character and pace of its economic and social development. Todaro quotes Professor Frederick Harbison's famous synopsis that

> Human resources . . . constitute the ultimate basis for wealth of nations. Capital and natural resources are passive factors of production; human beings are the active agents who accumulate capital, exploit natural resources, build social, economic and political organizations, and carry forward national development. Clearly, a country which is unable to develop the skills and knowledge of its people and to utilize them effectively in the national economy will be unable to develop anything else.

Todaro (1981) states that an institutional mechanism for developing human skills and knowledge is the formal educational system. Although such a statement is true, it is not easy to implement for adults are most likely to be the potential adopters of new technology. It is a fact that in many developing countries, the recipients of technology transfer are illiterate adults, many of whom are land owners.

Todaro (1981 p. 317) suggests that real and lasting educational needs for rural development can be established utilizing the educational typology of Coombs. Coombs groups educational needs for adults and youth under four main headings.

1. General or Basic Education: This branch of education is concerned with literacy, and elementary understanding of science and one's environment etc. Primary and secondary stages of education try to achieve this level.

2. Family Improvement Education: The objective is primarily to impart knowledge, skills and attitudes necessary to improve the quality of family life. It covers such subjects as health, nutrition, homemaking, child care, home repairs, improvement, and family planning.

3. Community Improvement Education: This is designed to strengthen local and national institutions. Instruction is given about local and national governments, cooperatives, community projects, etc.

4. Occupational Education: Knowledge and skills associated with various economic activities are developed enabling individuals to make a living.

The World Bank staff working paper number 406 (July, 1980, p. 55) emphasizes that the lack of human resources constitutes the major constraint on the development of Africa, south of the Sahara. The strategies for removing this constraint should involve:

1. Strengthening of public administration at both central and local government levels.

2. Greater effort at manpower development to improve the absorption capacity of the modern sector.

3. Formal and non-formal education programs to create in rural areas, a healthy human agent capable of perceiving and acting upon the opportunities for economic improvement provided by modern science and technology.

Role of Education

The World Bank Development Report (1980, p. 46) mentions that every individual is born with a collection of abilities and talents. Education in many forms has the potential to help fulfil and apply them.

Many of the non-cognitive effects of schooling such as receptivity to new ideas, competitiveness and willingness to accept discipline are relevant to economic activity.

The World Bank Report (1980, p. 48) gives empirical evidence from agriculture on direct measurements of productivity, yields and innovative activity of schooled and unschooled farmers. In Brazil, Colombia, Kenya, Nepal, Malaysia, South Korea and Greece a combined calculation showed that on the average, the annual output of a farmer who had completed four years of primary schooling was on the average 13.2 percent more than one who had not been to school. Indeed, this is an indication of lack of education as one of the barriers to reception and use of modern farm practices.

Non Formal Education

Coles Townsend (1977) uses Coombs' definition of non-formal education as: "any organized, systematic, educational activity carried on outside the framework of the

formal system. It provides selected type of learning to particular subgroups in the population." Because potential adopters of new agricultural technology are in most cases, adult farmers, adult education will be examined.

Philosophy and Program Areas of Adult Education

Long (1983, p. 9) says that adult educational programs tend to reflect particular philosophical orientations. The programs are concerned with humanity, needs, purposes of education and institutional mission.

Long (1983) uses a list by Lord (1980) developed at the University of Georgia Centre for Continuing Education. Five major subject matter or content dimensions appear in that list. For each area, there are related sub-areas. Only three of the five content dimensions and relevant sub-areas are pertinent in reference to this project. Note that they overlap because in education, it is difficult to set exact boundaries. The dimensions are as follows:

1. Problems and issues of society.
    (a) Social change
    (b) Agricultural and food production
2. Subjects of personal interest
    (a) Trades and technology
    (b) Agriculture and food production
3. Skills and/or knowledge for occupational improvement
    (a) Trades and technologies
    (b) Agriculture and food production

Adult Teaching and Learning

Shute and Moore (1982) in discussing introduction to teaching and workshop methods in agriculture remark that: almost everyone concerned with the world food system is or soon will be aware that without greatly accelerated education and training, there is little hope the world will be able to feed itself adequately, regardless of

technological improvements. These authors use the philosophy that learning is the change in ability, skill, information or motivation which takes place in the learner. Learning is what is left after a specific educational event or experience is concluded. For the majority of adults, learning is valued because it will enhance their ability to deal with problems of every day life. Shute and Moore remark further that adults are not eager to return to the classroom because memories of their own schooling relate to activities which no longer interest them and for this reason:

1. Adults are independent and able to make their own decisions.

2. Adult life is centered on problems or tasks, not on objects as in primary or secondary schools.

3. The only characteristic that adults share is independence. The longer adults live, the more they vary from other adults in experience, responsibilities, needs and interests.

Kahler, Morgan, Holmes and Budy (1985, p. 26) in discussing methods of adult education refer to Maslow's Hierarchy of Needs classification system to be: (1) need for self actualization, (2) esteem needs, (3) need for love, affection and belongingness, (4) safety needs, and (5) psychological or survival needs.

In addition, these writers list some characteristics of good objectives for adult educational activities. The objectives emphasize that:

1. They should be behavioral, functional, definite and attainable.

2. They should indicate the specific changes that are to be made in the behaviour of the people who are being educated.

3. They should be accepted by the people as their objectives and provide an opportunity for a larger number of the people to move some distance in the direction that they want to go.

4. They should be so formulated that the degree of their achievement may be evaluated.

5. They should lead towards the general aim of education.

6. They should be stated in terms of knowledge, skills, interests, understanding, abilities, appreciations, ideal practices and habits to conquer educational barriers.

Social

Consideration of relevant social systems is important in understanding group life undergoing change. A social system can be conceived as a concrete interactive social structure. The members of such organizations interact more and influence decision criteria to technology adoption. On the other hand, a social system may be viewed in abstract terms in which patterns of relationships prevail from generation to generation and from region to region (Loomis and Beegle, 1975, p. 2). Social norms, roles, power and rank can and do create barriers to technology transfer. Rogers and Burge (1972, p. 353) indicate that the degree to which an innovation is perceived as consistent with existing values, past experiences and needs of the receivers is related to adoption of new technology. An idea that is compatible will be adopted more rapidly than one that is incompatible. Adoption of an incompatible innovation often requires creation and adoption of a new value system which might create additional barriers.

Social barriers to technology adoption are rooted in social systems. Rogers and Burge (1960) define a social system as a collection of individuals who are oriented to a common goal. Members may be individuals, informal groups, organizations or subsystems. Rogers and Burge state that it is important to remember that diffusion occurs within a social system because the social structure of the system affects the innovation's diffusion patterns in several ways, principally by providing boundaries within which innovations diffuse. A system's norms can be a barrier to change. They affect an individual member's innovation - adoption behaviour.

Social Change and Action

Strasser and Randall (1981) in stating assumptions about the nature of society and the interest of social scientist point out that inquiry into these assumptions is of

fundamental importance. The explicit and implicit assumptions about man and the social body determine how the phenomenon of change will be conceptualized and eventually explained. Strasser and Randall specifically stress that to understand social change one should understand its double character. They indicate that social change is a product of human actions and that action of society members produces history which facilitates potential for social change. On causes of social change, they feel that most sociological explanations of the origins and causes of change may be categorized into (1) changes inherent in any given organization of society, or (2) changes seen as a consequence of external impacts.

In social action, Strasser and Randall (1981) refer to literature by Smelser (1962) where the following four basic components of social action are stated:

1. Values.
2. Norms.
3. Mobilization of individual motivation for organized action.
4. Situational facilities.

Values are generalized ends that provide the broadest guide to purposeful social behaviour. Norms on the other hand are regulatory principles necessary if the values are to be realized. Mobilization of individual motivation to organized action determines who the change agents are, how the actions of these agents will be structured; roles, organizations and how rewards will be given. Situational facilities are means or obstacles that facilitate or hinder the attainment of goals.

Farmer Adoption Behaviour

Leagans (1979) in his mimeograph on adoption of modern agricultural technology by small farm operators, says that the development of a scientific market oriented agriculture involves many diverse factors and their related variables. These factors affect the behaviour of the adopter farmers when accepting innovative methods. Among these factors are the farmer's attitudes, how others impinge on him, and his environment.

Efforts to adopt innovation brings these factors of influence into direct interaction, but only as they accommodate to one another can innovative action be successful. Adoption behaviour tends to be specific to particular innovations, individuals and environment.

Characteristics of Adoption Behaviour

Some characteristics of adoption behavior have been examined by Leagans (1979). He indicates that:

1. Adoption behaviour is adult behaviour.

2. Traditional socio-economic factors such as farm size, owner's age, education, income and family size generally influence adoption behaviour only indirectly. But they do create conditions that may influence the adoption of subsequent agricultural innovations.

3. Farmers incentives and disincentives to adopt are determined by his personal beliefs about his environment.

How Social Organizations Stimulate Change

Ryan (1969) mentions that social organizations stimulate change and that technologies hold functionally integrated relationships to tools. Norms have some consistency with social values while individual aspirations bear relationship to societal values. In addition, Ryan says that the mechanisms of social mobility are related to the goals set out in value systems.

Ryan (1969) conceives of every innovation as being presented to an actor for his evaluation resulting in the actor and the innovation becoming two immediate variables. Ryan states that several dimensions affect the judgement of the actor, a few of them area:

1. The social position of the actor.

2. The qualities of perceptive process i.e. the criteria upon which the actor judges the innovation as a basis for conscious decision. The evaluative criteria involve the

following three areas:

(A) Evaluation in terms of innovation consistency with sacred norms and undefinable truths and symbols.

(B) Evaluation in regard to its desirability.

(C) Evaluation in terms of aesthetic standards.

Social Forces

Lacy William in Social Forces (Vol. 64, September, 1985) points out that rural sociology shows an interest in technological innovation and social change. In this article, technological determinism and social change are viewed as mutually intertwined and reciprocally related. The article indicates that interest has shifted from micro-level concern with farmers adoption of innovation to structural and societal issues. Characteristics of societal structure are critical in determining the ultimate effect of technology on the welfare of different groups in society. The transfer of technology often leads to less community autonomy, more dependence on the wider society and greater inequality within the community.

Economic and Political View

Lee Yu Han and Hayden F. Gregory in the Journal of Economic Issues (Vol. 20, No. 3, September, 1986 p. 799-804) discuss a theory of technology. They affirm and emphasize that life in general and life in particular have evolved not by living within limits but by overcoming them. They argue that by overcoming limits, people live longer, better lives, so the alternative technology prescription of living within limits is ultimately self defeating.

Katz and Shapira in the Journal of Political Economy (Vol. 94, No. 4 of August, 1986 p. 822-41) discusses technology adoption in the presence of network externalities. These writers conclude that the benefits that a consumer derives from the use of a good, often depends on the number of other consumers purchasing compatible items.

Cultural

Culture is the total man-made part of man's environment. The ideas and beliefs of man and the material things that he has to work with set limits on what he can do at a given time and place, and very often how it may be done (Lionberger, 1960, p. 10). This sociologist says that perhaps the influence of cultural factors in farming stands out in clearest perspective when the behaviour of people in different backgrounds are compared. Studies of the adoption of farm practices have repeatedly shown that exposure to many and varied sources of farm information and influence is associated with high rates of adoption.

Scholars explain the concept of culture in different ways and terminology. For the purpose of this project, the definition by Everett Rogers and Rabel Burge will be used. Rogers and Burge (1972, p. 30) definition is that culture consists of material and non-material aspects of a way of life which are shared and transmitted among the members of a society. This definition can be broken into three parts as follows.

1. Culture includes both non-material and material aspects of a way of life. Non material aspects include attitudes, values and knowledge, while material culture are actual possessions.

2. Culture is shared and transmitted. Similar patterns of cultural behaviour are passed on to new members entering the society by the process of socialization and learning.

3. Culture is possessed by the members of a society. A subculture contains many elements of the broader culture of which it is part.

Rogers and Burge (1972) indicate that understanding the cultural context is important if programs are to be successful. Culture can hinder or assist planned change. Cultural values may serve as a block to introducing new ideas. Subcultural differences between change agents and clients pose potential obstacles to effective communication and change.

Traditional Cultures

In many parts of the world, cultures adhere to the belief that man has no causal effect upon his own future or the future of the land; God, not man can improve man's lot (Mead, Margaret, 1958). An example of this is the situation where it is difficult to

persuade people to use fertilizer, or to save the best seed for planting since man is responsible only for performance and the divine for the success of the act. Mead (1958) further states that for farmers, programs for improvement are sometimes rendered ineffective because of failure to take account of what the people specifically value.

In many traditional societies, the large amount of time and human energy spent on ritual, magic and other religious practices seem to be wasted in the eyes of an agricultural expert. But to the native, they give him faith in his work, saving him from the anxieties which so often attend the work of a cultivator, and where agriculture is a total pattern of life, it means that the areas of religion and agriculture are not compartmentalized.

In peasant societies, conservatism appears to be culturally sanctioned (Foster,1962, p. 65). Higgins (1977, p. 107) asserts that since the vast majority of people in developing countries are peasants, when raising the question of resistance to cultural change and technological progress, one should have objectives in mind, some of which are that:

1. Substantial numbers must be willing to move into modern industrial sector.
2. People must be willing to work longer hours.
3. They must be willing to acquire new skills and use new techniques.
4. Some of them must be willing and able to perform entrepreneurial functions.
5. In some cases, they may also be required to limit family size if real progress is to be made.

Basic Assumptions About Culture

Moore and Lewis (1963, p. 114) in the article "Learning Theory and Culture in Current Perspectives in Social Psychology" give some fundamental assumptions about the nature of culture as shared by anthropologists and sociologists as follows:

Culture is learned.

Culture is inculcated.

Culture is social.

Culture is ideational.

Culture is gratifying.

Culture is adaptive.

Culture is integrative.

Radical View of Culture

Archer, in the British Journal of Sociology (Vol. 17, 1985, p. 333-353), argues that conceptualization of culture is extra- ordinary in two aspects: (1) it has displayed the weakest analytical development of any key concept of sociology, and (2) it has displayed the most wildly vacillating role within sociological theory.

Archer (1985) concludes that, commitment in advance to cultural coherence blinds people to the possibility that social change may occur through the replacement of a doctrine by a another one.

Communication

Webster (1971) defines communication as the sharing of meaning; it is the process by which an individual transmits stimuli to modify behaviour of other individuals. All communications involve three basic elements: a source, a message and a receiver.

The source has an objective in mind which can be accomplished by changing the knowledge, attitudes, goals, beliefs, or other predispositions of the receiver. To achieve that objective, the source must convey messages, combination of symbols, which transmit the intended meaning to the receiver. Webster (1971) remarks that, the characteristics of the communicator especially reputation and credibility are known to have significant influence on the respondent.

Language

Jenkins (1981 p. 21) points out that language is central to learning and a prerequisite for most human communication. A language develops to enable people to

communicate about things important to them.

Communication and Social Change

The learning process, the diffusion process, the change process and etc. all basically involve communication of new ideas (Rogers, and Shoemaker, 1971, p.11). Communication factors are involved in many aspects of decision making processes which together make up social change. Although communication and social change are not synonymous, essentially, the concept of social change includes, in addition to the communication process, the societal and individual consequences that result from adoption or rejection of an innovation (Rogers and Shoemaker, 1971).

Diffusion as Communication

Rogers and Shoemaker (1971) point out that diffusion is a special type of communication. It is the process by which innovations spread to the members of a social system. Diffusion studies are concerned with messages that are new ideas. In communication research, the focus is on attempts to bring about changes in knowledge or attitude by altering the make up of the source, message, channels or receivers in the communication process. In technology transfer the objective is to bring about behaviour change, that is, adoption or rejection of new ideas rather than just changes in knowledge or attitude.

Lamble (1984) asserts that diffusion is a special type of communication but adds that it is concerned with messages that are perceived by receivers as being new and therefore a degree of risk is present for the receivers. This phenomenon leads to somewhat different receiver behaviour, usually more cautious behaviour than if they were receiving messages about routine ideas. Such circumstances create a barrier to change.

Lamble (1984) says that the essence of diffusion process is the human interaction by which one person communicates a new idea to one or more other people. In basic form, the key elements are:

1. The Message: This is a new idea or practice (innovation).

2. The Source: This refers to an individual who has the knowledge of the innovation.

3. The Receiver: A receiver is another individual who is not yet aware of the new idea.

4. The Channel: This is some sort of communication linkage connecting the two individuals.

5. The Effect: The resulting changes in knowledge, attitude or behaviour of the receiver.

Basic Language Communication

Burk, Fry and Minja (1984) give three basic components of communication as: (1) spoken language, (2) written language, and (3) visual language.

Spoken Language: This component allows the receiver to feed back the information to the sender as soon as the message is received. Feedback enables the sender and the receiver to check each other's perception of the message.

Written Language: Written language should have a clear purpose, it should be positive. Use of sentences in active voice is better. It should be precise and non-sexist. This is a barrier in cases where the receivers are illiterate.

Visual Language: In the context of information transfer, visuals represent real things. To be effective, it should represent reality as clearly and as understandably as possible.

Psychological

Long (1983) remarks that philosophical orientations of most planners of adult educational programs are based on behavioral, cognitive and humanistic schools of psychology. Hollander and Hunt (1963) define social psychology as a field of study which takes as its problems the understanding of social behaviour. It seeks to determine the factors affecting the relationship between individuals either in person to person interactions or with

respect to larger groups, institutions or society. The distinctiveness of social psychology arises from two features: (1) its essential focus upon the individual as a participant in a process, and (2) its concern with the analysis of these processes.

Research Programs in Social Psychology

Newcomb (1963, p. 9) outlines some research programs postulates in social psychology as follows:

1. Any observable behaviour is not only a response which is to be treated as dependent variable, it is also a stimulus to be perceived by others with whom the subjects interact and thus to be treated as an independent variable.

2. There is a correspondence between the psychological process of the overtly behaving individual and those who perceive and relate to him.

3. The relations among the parts of such systems are quite different from relations of individuals to inanimate objects.

Construct Theory and Emotions

Katz Owen in British Journal of Psychology (Vol. 75, 1984, p. 315-327) discusses personal construct theory and emotions. He mentions that the basic idea underlying the theory is that each individual builds for himself a system of constructs which he uses to anticipate and control events and to make sense of his phenomenological world. Within an individual construct system, each construct is related to others via implicative or subsumptive relationships. In this theory, an individual's behaviour is governed not by learning or reinforcement but by ways in which he anticipates events and gives meaning to his world.

Katz (1984) gives a concise expression of the psychology of constructs provided by Kelly (1955) through fundamental postulates and corollaries as follows:

Fundamental Postulate: A person's processes are psychologically channelled by ways in which he anticipated events.

Related corollaries are as follows.

Individuality Corollary: Persons differ from each other in their construction of events.

Choice Corollary: A person chooses for himself that alternative in a dichotonomous construct through which he anticipates the greater possibility for extension and definition for his system.

Communality Corollary: To the extent that one person employs a construction of experience which is similar to that employed by another, his psychological processes are similar to those of the other person.

Psychological Characteristics Affecting Innovation Adoption

Lionberger (1960, p. 98) points out that a number of personal characteristics related to adoption of new farming practices include: (1) rationality, (2) mental flexibility, (3) dogmatism, (4) orientation towards farming, and (5) innovative process.

All people are to some degree "set in their ways and to a degree incapable of perceiving pertinent relationships in new situations, of analyzing them in terms of adjustment alternatives and of making satisfactory adjustment to them (Lioberger, 1960). People vary greatly in this respect. The farmer who is inclined to mental rigidity tends to resort to the traditional formula of hard work, persistence and thrift in matters of farm management. A mentally flexible person, on the other hand, is capable of perceiving significant elements in novel situations, of dealing with them emotionally and of making adjustments to them.

Motivation: Psychological Base

Motivation is the drive which forces a person to move towards a goal (Mutava, 1981). Each individual has certain basic and acquired drives. The drives are goals aimed at gaining affection, money and eminence. Mutava (1981) points out that it is not an acquired drive which causes humans to act but an anxiety state produced by absence of a supposed need. Mutava (1981) refers to Verner's view of motivation. This theory

examines motivation as: a goal directed behaviour which grows out of the needs of an individual at a specific point of time in a specific situation. The nature and quality and intensity of motivation is influenced by such factors as knowledge, task, previous experience, social role, etc.

Educators should be aware that the following factors might be relevant to adult motivation.

1. Since in most cases, participation in adult education is voluntary, we must assume that the undertaking of this activity demonstrates some personal need.

2. Personal needs are shaped, conditioned and channeled by social structures and forces.

3. There is interaction between social and personal forces which include the following:

(a) When strong personal needs move people toward a particular educational objective, the congruence should result in a high level of participation in programs relevant to that objective.

(b) When strong personal needs among a particular group of people move them towards an educational objective, but there are no supporting or facilitating social forces, the participation level will be low and generally spottily high.

(c) When personal needs in a particular group are weak, but social forces are strong, participation originally will be fairly high, but may drop sharply after an initial period.

(d) When personal needs and social forces conflict, the participation level will depend on the strength of social force in the given situation but there will be a considerable amount of tension within the program itself.

Chapter III

Principles of Extension and Technology Transfer

A. Background

Extension education was developed from a movement at the University of Cambridge in 1873 (Draper, 1923). The University of Cambridge pioneered the movement when it took action on a report from its syndicate concerning various memorials asking for lectures in provincial towns. The deliberations were opened to all colleges, by establishment of a peripatetic university whereby, professors would circulate among large towns enabling the interested public to attend lectures. Crude forms of extension, however, had existed long before this time. In America, for example, a teacher at Queens College offered public lectures on chemical philosophy in 1816. Blackburn and Vist (1984) trace early forms of extension back to 1606, in Canada, when an experimental seed plot was sown in Nova Scotia.

B. Extension Education

Blackburn and Vist (1984) refer to J. P. Leagans' definition of extension education as: "The process of working with people not for them; of helping people become self reliant, not dependent on others; of making people the central actors in the drama, not stage hands or spectators; in short, helping people by means of education to put useful knowledge to work for them."

Leagans (1971) defines extension in functional terms as: "An applied science consisting of relevant content derived from researches in the physical, biological and social sciences, and in its own process, synthesized into a body of concepts, principles, and procedures oriented to providing non-credit out- of-school education largely for adults."

Swanson and Claar (1984) define the concept as: "An ongoing process of getting useful information to people (the communication dimension) and then in assisting those people to acquire the necessary knowledge, skills and attitudes to utilize effectively this information or technology (the educational dimension). Generally, the goal of extension

process is to enable people to use these skills, knowledge and information to improve their quality of life."

Role of Extension in Technology Transfer

Blackburn and Vist (1984) indicate that, when one talks of extension, one must also speak of technology transfer especially in these days of fast moving technological changes. Technology transfer is an integral part of extension process, involving the transfer and spread of technology, technical information or know how from information sources, or developers through those who communicate it, to those who receive it.

Johnson and Kellog (1984) present a four step approach in extending new technology to farmers. This approach is:

1. The diagnosis of farmers' circumstances and actions in a target area.
2. Planning and designing of technological adaptation.
3. Farm testing and verifications of results.
4. Carrying out multi-locational field trials and dissemination of results.

Extension plays a key role in selection of target areas, and diagnosis of farmers' needs and problems through formal survey documents. Further, extension plays a role in planning and design of technology adaptation through involvement of field agents in: (1) identification of target group of farmers, (2) laying out the groundwork for field activities, (3) considering alternative activities and methods, and (4) finalizing plans for field trials.

The role of extension in multi-locational field trials and dissemination is to ascertain timely operations during the trials. Once a trial is undertaken, promotion of diffusion strategies is again the responsibility of extension agents.

Philosophy of Extension Education

Blackburn and Vist (1984) examine the philosophy of extension education by using the following principles:

1. There is as much intelligence in the masses as in the elite, and educational opportunity will find and release it.

2. Since most people cannot come to school, school must go to them.

3. Education, which is learning for life, must involve the basic institutions - the family, the community, the school and the church.

4. New, freshly developed knowledge, is the wellspring of learning.

5. One learns best by doing.

C. Extension Programs and Methods

In 1959, a report of the committee on agricultural extension, organized by Agricultural Institute of Canada, outlined the following principles which are widely accepted in extension:

1. Extension programs should be aimed at the interests, goals, and perceived needs of people.

2. The programs should be broad and well balanced to meet complex situations of production, marketing, credit, etc.

3. The programs should be flexible to meet changing conditions.

4. Long term plans that anticipate future needs are desirable.

5. Priorities and targets should be set.

6. Extension programs should be democratically developed, and local associations involved.

7. Extension programs should be designed to meet educational needs of all classes.

8. An extension method should be selected so that the intended information is presented at the appropriate level of the ultimate users.

9. Since extension education is a process, programs must be developed gradually as people get ready for them.

10. Continuous effort and dedication by research and extension staff is required.

Extension Method Selection

No matter what extension teaching method is chosen, the decision to adopt an innovation, takes place in five stages: awareness, interest, evaluation, trial and adoption or rejection.

Kang and Song (1984) remark that there are a substantial number of proven educational teaching methods from which to choose in setting learning situations. The purpose is to maximize the transfer of information and skills to intended adopters of a new technology. The basic premise in method selection is that people learn through their own activity. Some criteria for method selection are that:

1. There is no single teaching method considered better than the other, a method is chosen that best suits a situation.

2. A number of teaching methods can be used to carry out a program. The more ways used, the better it is for the learners' understanding. Care should be taken, however, to ascertain that the methods used convey the same intended message.

3. Often teaching methods overlap in the teaching and learning process.

4. Visual aids and written material should be used whenever possible.

Individual Approaches

The individual approach involves an interaction on a one-to- one basis between an Extension Agent and a farmer or a farm family. The method enables the agent to know better the potential adopters and their needs. The adopter gets to know the agent, resulting eventually in a strong bond between the two. This approach is excellent but expensive and tends to be biased in favour of progressive farmers.

Traditional Techniques of Individual and Group Methods

Farm and Home Visit

Visits by an extension agent to individual farmers or farm families in their own fields or homes are the most effective extension teaching methods (Mosher, 1978). They

entail conversations, and are effective so long as the agent has a specific objective in mind. The strategies of this approach are:

1. To inform a farmer about an advantageous practice face- to-face.
2. To encourage the potential adopter to take action by practicing the new idea.
3. To motivate the clientele to be competent.

Office Calls and Inquiries

In this method, a client visits an extension office for advice. The approach is advantageous since a practicing farmer has a specific problem in mind when visiting the extension office. The system, however, is not convenient because distances and out-of-pocket resources do not allow all the clientele to make visits.

Informal Contacts

Informal contacts can take place anywhere. Celebrations and other community functions are times when agents and farmers can intermingle in an unstructured manner for free exchange of ideas. During the process, an extension agent could make comments about new farm practices and announce upcoming extension events.

Group Methods

Group teaching methods are more frequently used because more people can be reached with limited staff time and other resources (Kang and Song, 1984). In addition a group decision is necessary for the adoption of some technologies. A range of conventional group teaching techniques include method demonstration, result demonstration, field days, field trips and training and visit systems.

Method Demonstration

In this method, a new technique is demonstrated to a group of clients. During the event, the participants are given an opportunity to try the method using the principle of learning by doing.

Result Demonstration

Result demonstration is a comparative method where people are shown why a new practice is superior to an existing one. It is commonly used in crop farming where the differences in the results can easily be seen. This method requires empirical results to indicate advantages of a new practice to potential adopters.

Field Days and Field Trips

Kang and Song (1984) define a field day as a day on which an area containing successful farming or other practices is open for people to visit. Field days can be held on individual farms, experimental stations, research centres or institutional farms. The objective is to disseminate good practices through discussions and observations.

Field trips to agricultural areas are organized so that the target audience can observe agricultural technologies in those areas. The objectives of field trips are:

1. To provide first hand observation of beneficial practices used in other areas.

2. To enable the group to interact with hosts and officials who are knowledgeable about the practices in the area being visited.

3. To present a fresh learning environment as a stimulant to learning.

Training and Visit System

The training and visit system, popularly known as T & V, is a modified group extension method initiated and financed by the World Bank for use in third world countries. Benor and Baxter (1984) summarize the objectives of this approach as follows: To build a professional extension service from existing ones, capable of assisting farmers to raise production and increase their income. A key means is to create a dynamic link between farmers, professional extension agents and researchers.

General Principles of Training and Visit System

1. It is based on professionalism. Extension agents must be professional at all levels by being in close touch with relevant scientific developments and research. They

must pass this knowledge to farmers.

2. The extension service must come under a single line of technical and administrative command.

3. The major idea is the concentration of effort upon the task at hand.

4. It is timebound, therefore, messages and skills must be conveyed on a regular and timely schedule according to the events of the season.

5. To serve farmers effectively, the extension service must be in contact with them on a regular basis and on schedules known to farmers.

6. Regular and continuous training is required for extension agents on specific technologies to be conveyed to farmers.

7. A strong linkage between extension and research is needed to create a two way communication so that extension may represent farmers' feedback on farming problems.

D. Program Planning and Evaluation

Various extension educationists such as Beal, Dolan and Sharon, Boon, Boyle, Houle, Knowles, Lippit, Compton, etc. have developed program planning and development models in extension. The models have more similarities than contrasts. For the purpose of this paper, Boyle's definition will be given to present a broader view of developmental programs but Compton's model will be adopted to describe the principles of program planning and evaluation.

Boyle (1977) states that program development is a deliberate series of actions and decisions through which representatives of the people affected by the potential program are involved with a programmer. It is an attempt to plan an educational program to improve the state of being of the people. Boyle presents three types of programs as: developmental, institutional and informational. In practice, the three categories tend to overlap. Developmental programs aim is to identify major problems of a given audience then to develop an educational program to find the solutions. Ideally, there are three basic stages in developmental programming: (1) identification of the problems, (2) setting the objectives,

(3) taking action to reach the objectives.

Extension Program Planning

Compton (1984) describes planning and development of extension programs as a continuous and interrelated series of processes. They are conducted through a systematic sequence of actions to promote the diffusion and utilization of science based knowledge, relevant to a particular geographic area. Compton divides extension educational sequence into seven steps:

1. Assessment of existing problems and needs.
2. Identifying available resources.
3. Planning of a program.
4. Preparing teaching and learning plans.
5. Implementation or action.
6. Monitoring and evaluation.
7. Follow up.

The Planning Process

Compton (1984) divides the planning process into seven steps. Steps 1 to 5 are planning stages, while steps 6 and 7 involve the program action. The following steps therefore go on in a cyclinal manner:

1. Situational analysis.
2. Identification of needs, wants and interests.
3. Determining problems, resources and priorities.
4. Coordinating with other agencies.
5. Planning learning experiences and action programs.
6. Implementation.
7. Monitoring and evaluation.

Situational Analysis

Boyle (1977) describes situational analysis as the effort to identify the need, gap or condition that exists between what is and what should be. It is a community fact collection. Compton (1984) emphasizes that the local socio-cultural context of farm families and households must be understood at this step since local values and beliefs within the community are strong influences in the success of a program.

Identification of Needs

Needs, wants and interests have different connotations according to individual users of the words. Compton (1984) differentiates these words by calling peoples' interests aspirations, which lead to their wants. Wants are analyzed to identify needs.

Determination of Problems, Resources and Priorities

Based on interests, wants and needs, problem solving becomes complex. The general principle is to identify and list all available information, examine the validity of the information, and take the most relevant action to solve the problem (Compton, 1984). Consideration of forces which work against the solutions should be considered at this time.

Coordination with Other Agencies

Extension personnel need to coordinate their activities with those of other service agencies and share information about mutual clientele. Compton (1984) reveals that duplication of duties by government services may cause as many problems as it solves, if not coordinated. It can be generally concluded that sharing information with other serving agencies can result in higher staff motivation and improvement of project success.

Planning Learning Experiences

Once a teaching method is chosen, a wide range of available resources can be selected for application. Instructional models, devices, demonstrations, film strips, etc. have been developed. At this step, educators should specify how the learning experience outcome will be

evaluated.

Implementation

This is the practical stage in which a practice is put into use. Ideally, a calendar of teaching events is scheduled according to activities at different times of the season.

Monitoring and Evaluation

In any planned program, there are things which may create problems or projected activities which may be found to have been based upon false assumptions or inaccurate information (Compton, 1984). Program adjustment would in such circumstance become necessary. Puttaswamaiah (1980) emphasizes that all systems require evaluation. Evaluation is a stock taking exercise with respect to goals and objectives. The philosophy is based on application of standards of rationality in the performance of visualized tasks. Evaluation studies are diagnostic and strenuous in character. Systems of scientific monitoring, feedback, regular re-testing, of the basic goals and modes of program operations are important. An evaluator searches for factors which favour or hinder the achievement of the project objectives. Modern statistical tools of analysis are available for the purpose if required.

E. Extension Service in Kenya

In Kenya extension service is a government responsibility. Other organizations and agencies such as parastatals and boards contribute to extension through the sale of farm inputs and products. Sessional Paper No. 1, Kenya (1986) indicates that the key to a successful extension service lies in its ability to put well trained officers into the field, supply them with useful advice for farmers and maximize the number of contacts that the officers have with farmers. The training and visit system of extension recently introduced in Kenya is intended to do this. Further, the success of the national extension project will depend on the flow of suitable technology to farmers (Development Plan, Kenya 1984/88). Research staff will be involved in monthly workshops and in designing, supervising and analyzing

comprehensive series of farm trials.

Organization

Extension Service is administered under technical services within the Department of Agriculture. The organizational structure is a top down design chain of command. At the national level is the Director of Agriculture, while each province is headed by a Provincial Director of Agriculture. Districts are manned by District Agricultural Officers. Moving down the ladder are the Divisional Extension Officers who are the first line supervisors in charge of technical assistants, who are the actual extension agents in contact with farmers.

Staff Qualifications

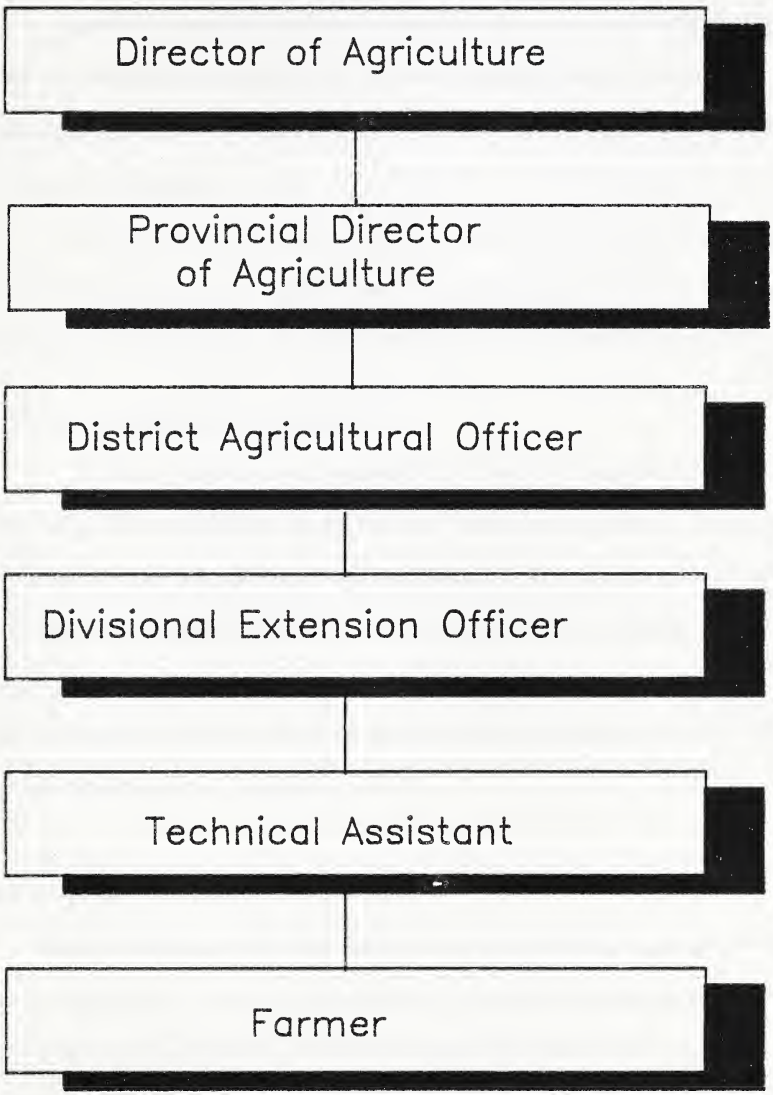
The Director of Agriculture, the Provincial Director and the District Agricultural Officers are university graduates. Divisional Extension Officers have diplomas from recognized agricultural colleges while the Technical Assistants are graduates from agricultural training institutions. For the purpose of this project, training at diploma and at technical assistant level will be briefly discussed with special emphasis on extension education.

Extension Education at Diploma Level

Various extension and rural sociology courses are offered to prepare the graduates to serve farmers in various capacities. They are prepared to work as supervisors, demonstrators, trainers, managers etc. depending on the nature of duties prevailing at a particular time and place. In Egerton College, for example, four levels of extension courses are offered. The brief presentation at each level is only an overview and does not therefore cover the syllabus in detail.

Level I: This level covers an introductory analysis of human society with special reference to an individual, the family, the community and their related social systems. Role relationships, community processes and attitudes towards change are taught. Social action, diffusion and adoption processes are also covered at this level.

Kenya Extension Services



Level II: This stage covers the philosophy and principles of extension including background history of extension and government service. Responsibilities and duties of extension educators are included in the principles of extension.

Level III: Level III involves extension teaching methods with emphasis on group, mass and individual approaches. In addition, program planning techniques, implementation and evaluation are dealt with at depth to enable graduates to participate in future field projects.

Level IV: This level deals with group dynamics and communication. Since the role of groups is vital in rural development, it is introduced and lectures dealing with community relationships, leadership development and organization are offered.

Training at Technical Assistant Level

Technical Assistants are prepared for front line programs by being offered a two year program in agricultural production and extension procedures. The training objectives are oriented to direct extension work and, therefore, include, in general, human resource management, interpersonal relations, and group extension methods. Use of national languages to reach the public is a prerequisite to success in communication and students are encouraged to use it as much as possible during training (Curriculum Development for Bukura Institute of Agriculture, 1975).

F. Field Extension Teaching Methods in Kenya

Technical Assistant Extension Agents are the link between agricultural research and the small scale farmers. Very little information or technical innovation reaches the small farmer without passing through a technical assistant (Leonard, 1977). Leonard stresses that since the farmer has little access to information on innovations other than through the agents, the communication processes by which the extension agents are kept informed is very vital. There are many possibilities for breaks and distortions in the chain, linking the farmer to the sources of technological information (Leonard, 1977). On patterns of communication, Leonard notes that senior officers communicate information to their field staff through a

chain of command. Several factors affect the transmission of these messages; message quantity, timing, and how they are transmitted. These factors might create barriers to information dissemination.

Methods

Research studies in Kenya show that the most commonly used extension method is the individual farm visit (Wyeth, 1981). Heyer and Waweru (1976) found that farm visits are an inefficient method in reaching farmers. Individual farm visits have been criticized for being costly and biased because only progressive farmers are visited. Other methods, namely demonstrations, meetings, agricultural shows etc. do not seem to be more effective than farm visits.

Diffusion Theory

Wyeth (1981) says that choosing progressive farmers as a source of diffusion of innovations is more of a theory than a practice. Studies and observations tend to show that poor farmers are less likely to follow examples set by the better farmers. This is because the progressive group tends to be separated in the ways they act. Further, the progressive farmers do not have enough time and interest to teach others. If anything, they would prefer to remain ahead of others for social prestige. An improvement of extension approach and supervision is now being undertaken through training and visit system mentioned earlier in the chapter to reach more of the poorer farmers.

Training and Visit System in Kenya

The technique of the training and visit system of extension now on trial in Kenya is the retraining of local extension agents combined with frequent visits to farmers' fields. The technique is based on the total number of farm families an extension worker can reasonably expect to work with. The number of families to be reached depends upon the farm population density in a given area, physical infrastructures and transportation system available to the

agent. Farm families to be visited by an agent are divided into equal groups. Within each group, a contact farmer is selected. The group meets on a pre-arranged schedule, on the same days of the week. During the meeting, information relevant to the farming activities at that time are presented to farmers by an extension worker.

Training of Agents

Every two weeks, the change agents are trained by subject matter specialists from the district office. Ideally, the training venue should be convenient for a practical demonstration if need arises. Each training session covers major farm activities which farmers will undertake in the following two weeks. An important event during the training session is the free exchange of ideas between the front line staff and the subject matter specialists. The field agents discuss farmer's problems as a feedback strategy.

Every month, researchers meet with the district subject matter specialist. The specialists are supplied with new research findings and techniques for problem resolution by the researchers. This training session creates an opportunity for the specialists to present farmers' problems as received by the front line extension agents. In this system, few farmers have access to direct information from researchers.

Effective extension programs require a statement of objectives. These objectives are essential in the development of programs, their implementation and evaluation. Cooperation is needed among research scientists, extension personnel, farmers and other groups to facilitate agricultural development. Agricultural development in Kenya relies heavily on the success of extension services for the dissemination of agricultural knowledge to farm families. Knowledge of the target agricultural communities would strengthen the linkages between the groups involved in agricultural development.

Chapter IV

Barriers to Technology Transfer In Kenya

A. Introduction

One of the challenges facing Kenya is the need to increase and sustain food production to meet growing demand. This is augmented by an approximate annual population growth rate of four percent. In addition to domestic food supply requirements, the agriculture sector should continue its significant contribution to foreign exchange through major cash crops such as coffee and tea. These objectives require technological advancement.

Once technological change is seen as central to food production, it becomes necessary to weigh the relative importance of three sets of relevant policy questions. Mellor, Delgado and Blackie (1987) outline the questions as follows:

1. What is the nature of technological problems that science must overcome to boost productivity on a sustained basis and how adequate are current research and extension methods?

2. What are the roles of other support services and infra- structure including provision of inputs, output marketing system, roads and governing institutions.

3. What incentives would influence farmers to produce more once the technological potentials are available and the necessary input and output marketing channels are in place?

We must assume that in Kenya, technology is obtainable. However, to facilitate agricultural development, the technology must be transferred to as many farmers as possible.

Policy programs have been designed to achieve this but constraints prevail. Before turning to the specific barriers being discussed in this project, the nature and strategies for agricultural development will first be reviewed.

Agricultural Dualism

Kenya's agriculture sector is dualistic in character. There are commercial farms on one part and small scale sector on the other. The commercial sector has its own dualistic nature in

that there are farms oriented to export production and others oriented to production of domestic food supplies. The small scale sector has its dualistic nature too. There are well developed intensive mixed holdings which produce both cash and food crops while on the other side are those which produce purely for subsistence consumption. The complicated nature of agricultural production in Kenya requires decentralized planning to meet specific situations.

Small Farm Sector

The small farm sector is well rooted in Kenya and resource allocation towards development of the small holder farms has been and is still a popular policy program in agriculture. In 1976, the small scale sector had one and a half million small farms, the majority less than two hectares and very few more than five (Heyer and Waweru, 1976). It is, however, difficult to ascertain the actual number of farm holdings in the small scale sector due to varied population density and frequent land subdivision. Small farms are concentrated in the highlands with distinct diversities in development across the landscape. Existence of well developed holdings with intensive crop and livestock production systems are impressive with substantial amounts of small scale technology in use. In contrast, numerous underdeveloped parcels are still common.

Institutions to Serve Agriculture

Several institutions, agencies and organizations serve agriculture in Kenya. Universities, agricultural colleges and institutions train manpower in various disciplines of agriculture and animal production. Parastatals (semi-government bodies) and boards have specific roles assigned by the government. Farmers' organizations, especially cooperatives, assist their members to obtain farm inputs and to market their products. From the preceding discussion, it can be concluded that farming receives reasonable attention from the government, but the speed of development is retarded by various barriers to technological change.

Current Development Strategies

For Kenyans to enjoy modest improvements in their present standard of living, it is imperative that agriculture remain the leading sector in stimulating economic growth and job creation (Sessional Paper No. 1, Kenya, 1986). The great majority of new jobs need to be created through prosperous agriculture. Although the development strategy strains the rural economy, it is a pre- requisite since 85 percent of Kenyan population is rural. The nation's farmers have to lead the way through higher agricultural production.

Kenya's Development Plan (1984 - 1988), challenges agriculture to:

1. Provide food security for an estimated population of 35 million in the year 2000.

2. Generate farm family income to grow at a minimum of 5 percent a year for the coming 15 years.

3. Absorb more productive new farm workers at a rate of over 3 percent a year.

4. Supply export crops sufficient to increase agricultural export earnings by 150 percent by the year 2000.

5. Stimulate the growth of productive off-farm activities in the rural areas.

Food Situation

Food security is a major objective of the government. The country continues to be self sufficient in pulses, maize, potatoes, vegetables, milk and meat products. The challenge, however, is to intensify production to keep pace with demand arising from rapid population growth and anticipated income growth. High productivity per unit of land can be attained through technological advancement and sound resource management.

Plan Objectives

To facilitate the success of the set objectives, policy framework is oriented to:

1. Optimize resource allocation to most productive use.

2. Create efficient market channels for input purchase and product sales.

3. Channel farm credit where it gives high returns.

4. Guarantee reasonable access to the use of land.

5. Supply relevant new agricultural technologies by providing the mechanism to transfer the necessary knowledge and skills to farmers for adoption and diffusion of new ideas.

6. Avail farm inputs at affordable prices.

7. Facilitate prompt payment to producers.

Policy Programs

The policy programs are geared to:

1. Focus on small farms.

2. Intensive crop and livestock production methods.

3. Increased research and improvement of extension services.

4. Market price incentives to motivate farmers to produce.

5. Improvement in resource management.

The key factor to implementation of these policy programs is the elimination of barriers to technology transfer.

B. Economic Barriers

Disincentives

Rop, Russell and Henneberry (1986) state that stabilization of domestic food prices at low levels can be of economic concern. Many food commodities are marketed through government regulated agencies which are commodity specific. The agencies advise government on marketing strategies. Breakdown in coordination among the agencies do occur in price setting. For example a given agency tends to ignore the existence of other agencies, thus, co-affecting commodity substitution at the farm level. Such actions can result in observed production distortions leading to rejection or slow adoption of technology.

Welfare Optimization

Delays in produce payments have been known to have negative effects in farm operations and technology reception. These delays come when policy guidelines for agricultural marketing are designed through pricing rather than quantity (Rop, Russell and Henneberry, 1986). Such a decision is biased. Accordingly, producer prices are relatively higher than consumer prices. Such prices implicitly become a form of welfare optimization to consumers. They are formulated under unstable domestic and external environments. Discouragement results in shifts in production technology from agriculture.

Price Support

McCarthy and Mwangi (1982) in projecting Kenyan agricultural development to the year 2000, indicate that price support systems have played a useful role in encouraging innovation. This has been achieved by assuring prices of certain crops. Kenyan farmers are price responsive and are generally aware of market opportunities. McCarthy and Mwangi (1982), however, argue that price support may be justified only in cases where the government is trying to expand production of a new or neglected crop. The general view is that both farmers and consumers would be better off if price supports would allow farmers to obtain profits.

Marketing Policy

McCarthy and Mwangi (1982) found that the government not only provides marketing organizations for many crops but frequently forbids trade carried out through unauthorized channels. Further, single market pre-announced prices may cause illegal and semi-illegal trading. Market control effects both small holders and commercial sectors. The smaller farmers feel the weight more and tend to be discouraged to use new innovations especially if profit margins are too narrow.

C. Educational Barriers

Todaro (1981 p. 271) in the article on "Education and National Economic Development in Kenya," reviews some important issues. He remarks that one cannot discuss the relationship between education and development in Kenya without implicitly linking the structure of the educational system to the economic and social character of the society.

Education can influence the future shape and direction of society in a number of ways, some of which are:

1. By reflecting the socio-economic structure of the society in which it functions, educational systems tend to perpetuate, reinforce and reproduce that economic and social structure.

2. Educational reform whether introduced from within or outside the system, has great potential for inducing corresponding social and economic reform in the nation as a whole.

Education and Rural Development

Todaro (1981) points out that if national development is to become a reality in Kenya, there is need for a balance between rural and urban development. Review of educational needs in the context of far-reaching transformations of economic and social structures is vital. Institutional relationships to processes of change in rural areas need to be critically studied. The goals of rural development cannot be restricted simply to agricultural growth, they should also be viewed in terms of total economic and social development through technological change.

General education has been well emphasized in developing countries, Kenya included. But critical learning needs for rural communities are equally important. Potential innovation adopters can be categorized and learning needs identified.

Potential Adopters and Learning Needs

Todaro (1981) categorizes potential adopters of agricultural technology in Kenya into (1) commercial farmers, (2) small subsistence and semi-subsistence farm families, and (3) tenants.

With reference to these categories, deficiencies exist in the following educational areas:

1. Farm planning and management.
2. Rational decision making.
3. Record keeping.
4. Cost and revenue computations.
5. Use of farm credit.
6. Application of new inputs and improved farm practices.
7. Storage, processing and food preservation.
8. Supplementary skills for farm maintenance and improvement.
9. Knowledge of government services, policies, programs and targets.
10. Knowledge and skills of family improvement.

Adult Education

According to Kenya's Development Plan (1984/1988) the objective of adult education is to provide the knowledge, skills and attitudes adults require to participate more meaningfully in economic and social development. It is stipulated that the campaign to eradicate illiteracy through reading programs will be reinforced. This requires continuing education programs organized around the themes of family life, health, citizenry and rural development.

Literacy

Literacy in Kenya has an important bearing on the consumption and impact of communication (Mwaura, 1980, p. 23). Illiteracy in Kenya is estimated to be about 60 percent

of the total population. Realizing the need to eradicate illiteracy, the board of adult education was created in 1967 but little success has been achieved to date. In Kenya, the adult literacy campaign is an integral part of community development and mobilization of the rural population, whose vast energies remain largely untapped. No modern nation can be based on illiteracy no matter how well it is endowed with natural resources.

Mwaura (1980) feels that the literacy drive in Kenya is functional in nature. It is based on priority needs of the people. Further its aim is to improve the living conditions of the people through both social and economic amenities. Illiteracy is a serious problem in rural Kenya where the majority of the population lives.

Strategies for Adult Education

Nturibi and Ulzen (1980, p. 10) in a report of the regional workshop for directors and teachers of part time courses list techniques and methods of adult education as follows:

1. Adult education should be based on two way communication: (a) to bring academic disciplines to the people through adult educational institutions and (b) to integrate the norms, cultures and beliefs of the people involved into the educational system.

2. Adult education strategies can also be examined in terms of programs, teaching methods and techniques of formal training programs and non-formal education programs which include the following.

(a) Agricultural extension programs aimed at helping the farming groups as well as individual farmers to overcome obstacles they meet. This can be attained through introduction of improved farming methods to enhance agricultural productivity.

(b) Community development service to prepare people to participate more in nation building.

Problems in Planning Adult Education

Nturibi and Ulzen (1980) point out that adult education sometimes meets resistance among those engaged in it due to:

1. Lack of knowledge and skills about the act of planning.

2. Degree of failure of previous plans as this causes despondency and apathy in those engaged in the planning process.

3. Lack of data on which to build plans.

4. Bureaucracy which leads to frustration and delays.

D. Social Barriers

Technology adoption and social change are inseparable. Change is an outcome of acceptance of new ideas and putting them into use.

Mpithi (1976) says that by focusing on the social structure of agriculture, one analyzes the complementary, integrated elements and processes which make farming a way of life. It is a cultural as well as an economic activity. An examination of the social structure reveals various levels of socio-economic life within the rural environment and finds it to be a complex differentiated system with subsystems where the community relates to the household and to the individual in myriad multi- dimensional ways. Mpithi (1976) continues to say that the farm household is conceived as living in a dynamic and fluid environment, one that is full of complex cognitions, values, beliefs, artifacts, messages and ideas.

The Peasant Householder

The peasant householder lives in a complex community composed of group systems such as lineage groups, age-sex groups, religious and ritual groups. Conceptually, the peasant community becomes a means of denoting legitimacy in associations as diverse as peer groups, church committees, cooperatives, institutions, marriage and family. These are important variables in social change. Understanding the peasant farming system is therefore important to understanding the social structure and potential barriers to technological change in Kenya.

Characteristics of Peasant Farming Systems

The basic characteristics of the peasant farming system are that:

1. The family is the basic production and consumption unit.

2. Surplus production is encouraged for the purpose of exchange either within the community market places or in large urban centres.

3. Production activities are consistently integrated into cultural values, beliefs and sanctions of the society.

Mpithi (1976) reveals that studies in Kenya indicate that peasant farm management decisions on what to produce, when to produce, how to produce and for whom to produce are not based purely on economic factors. For example agricultural taboos determine what can be eaten. Determination of which tasks will be performed by different members of the household partially dictate answers to these farm management questions.

Common Property Problem

Livingston (1986 p. 5-19) gives an overview of common property problems in pastoralist societies as a barrier to technological advancement. Livingston (1986) found that a common property problem occurs where livestock is kept under individual ownership on communally owned land. Each individual maximizes pasture share by increasing his stock, leading to collective overstocking. Expansion of livestock holdings provides social pride and prestige. Acceptance of this common property model has affected investment and development policy. Investment in water, for example, helps keep more animals alive, beyond the carrying capacity of the land leading to land degradation and poor animal health. This condition offsets increased production. In this case, the value of rangeland gives rise to socio-economic barriers to technological change.

E. Cultural Barriers

Often, it is not easy to discuss cultural barriers without touching on social aspects. For this reason, most scholars tend to refer to them as socio-cultural barriers to change. Mpithi (1976) uses the socio-cultural phrase by saying that there are multiple socio-cultural norms affecting social change in African peasantry. Since culture is the product of learned behaviour, social institutions at the community level reflect the culture in which they exist.

In African peasantry, Mpithi (1976) says that:

1. Cultural taboos maintain strong and stable social structures.
2. Individuals are integrated into community production systems.

Kinship and Human Behaviour

Kinship ties in Kenya have a tendency to develop patterns of role relations extended to all members of a group. Such roles are bound to affect decision on cultural change and innovation adoption. Mpithi (1976) stresses that most studies of kinship in behavioral context tend to isolate some generalizations which pinpoint kinship interaction networks as essential in sociological studies. Ethnicity, for example, is very pronounced in rural Kenya forming a very strong subcultural phenomenon.

A substantial amount of basic human learning relates to other human beings in affective terms and on role differentiation on the basis of age-generation and sex. Allocation of status is done within kinship ties. In rural communities non-family organizations incorporate family obligations.

Processes of Cultural Change

One of the objectives of the Department of Culture in Kenya is to encourage cultural exchange within the country to enhance national identity and pride (Kenya Development Plan 1984/88). Among other things, the department is responsible for the revival and promotion of culture through oral traditions and national languages. In cultural change there are a number of processes involved. Only three will be briefly discussed in relation to changes and

innovation adoption: (1) cultural fusion, (2) reinterpretation, (3) compartmentalization.

Cultural Fusion

This is the blending of different traits, old and new. A new trait is accepted and an old one is allowed to survive. The fusion usually requires a reorganization to remove conflicting parts to create a new complex functioning whole. When not correctly compromised, it can create confusion and a strong barrier to change.

Reinterpretation

This concept is very close to cultural fusion but involves the identification of new traits with existing ones. In this process close correspondences in meaning, function or form are obtained.

Compartmentalization

This is a special form of cultural accommodation involving both retention of old traits and the adoption of new ones as sets of activities. In practice, each trait would then be used selectively depending upon the appropriate situation in which it is called for.

It is generally felt that compartmentalization as a process is an important aspect of acculturation especially in its initial phases. A trait is first adopted provisionally and then used interchangeably with a pre-existing one within an initial period of experimentation. As its greater importance or usefulness is realized, the frequency of its usage is increased and the older trait is accordingly abandoned. This is a general pattern of change in many societies, but may become fixed in certain circumstances and serve, instead, as a barrier to further accommodations.

F. Communication Barriers

Mwaura (1980) strongly points out that language influences the way in which people perceive reality, evaluate and conduct themselves with respect to the reality. Language controls thought and action. In this context, speakers of different languages do not have the same world view or perceive the same reality unless they have similar cultures or backgrounds.

Language is a product of culture and thought patterns. If communication media are to be part of a culture, then they must use the language of that culture.

Language Classification in Kenya

Whiteley (1974, p. 26) in his discussion on the size, distribution and homogeneity of the linguistic groups in Kenya says that, one of the major problems is the fact that, periodic consensus of the population have used ethnic rather than linguistic affiliations as a means of identifying people. Ethnic and linguistic units are, therefore, not easily comparable due to lack of precise information. Whiteley (1974) uses Kenya population census of 1962 and 1969 to name four major linguistic groups: Bantu, Nilotic, Para-Nilotic and Cushitic. In rural areas the ethnic and sub-ethnic languages are more homogeneous than in urban and small shopping centres. Heterogenizing influences are most marked along the lines of communication between and in the towns, in small trading posts, schools, health centres and mission stations.

Multi-lingualism

Whiteley (1974) agrees that in a community that is completely homogeneous linguistically, there would be no need for anyone to speak any other language as far as internal communication was concerned. But because of interacting, multi- lingualism exists at many levels of Kenyan society.

Language limits the passing of scientific knowledge to such groups. Mono-lingualism and multi-lingualism represent extreme forms of language competence and are a form of adaptation to a given social life which has to be considered when communicating new ideas. It is difficult to identify accurately which language people in a multi-lingual society would claim to be their official language. When a specific language is used by change agents, clientele might reject the communication.

Constraints to Communication in Rural Development

Studies show that elite members tend to form sub-cultural groups in Kenya based on western civilization and schooling. As change agents therefore, the elites are alienated from the parental culture they are supposed to change.

Mpithi (1976) gives some implications of the elite and the mass peasantry in relation to communication barriers. He observes that:

1. The development of an elite leads to cleavage in society, creating a barrier between educated youth and their parents.

2. There is a barrier in communication flow and feedback to elite planners from the masses.

3. There is perpetual apathy and a feeling of relative deprivation among the masses.

The above observations are important in designing and implementing rural projects because of the lack of communication between the elite and the rural masses.

Further comments on this issue are:

1. If the message of innovation from research is based on scholarly interest, the findings may not be easily communicable.

2. The language used to disseminate research findings might not be understood, interpreted and translated by the rural masses.

3. The research might reflect different meanings to rural communities than to the researcher.

Communication Technologies in Kenya

Research findings require proper communication channels to reach target audiences.

Kenya News Agency

Communication comes under the Department of Information in Kenya. Its function is to publish and distribute government publications and magazines. Provincial and district information offices gather news and operate public information libraries. A limiting factor of the Kenya News Agency is the number of people able to read and write.

Radio

Broadcasting is the most important means of mass communication in Kenya. Radio broadcasts are scheduled to enlighten both urban and rural communities in various programs ranging from sanitation, family planning, agriculture, etc.

Television

This is only useful in cosmopolitan urban centres.

Mobile Films

Mobile vans are used to travel and screen educational films in the countryside. Agricultural Information Service utilizes this process to communicate farming ideas and practices.

G. Psychological Barriers

Psychological barriers to technology transfer do not exist in isolation. They relate to mental processes taking place in a potential adopter's mind. For the purpose of this paper, adult motivation and attitude will be briefly presented. The literature though general applies to Kenya as well.

Motivation

Mutava (1981) mentions that most adults are self motivated in learning. Adults attend an educational event because they want to and not because they have to. In terms of adult education, it is widely accepted that many adult students doubt their ability to learn and study. They are sensitive and sometimes impatient, hence they constantly need to witness their progress and repeatedly need to be assured that they are making progress.

Psychological motivation is important in technology transfer strategies. When introducing a program, people should feel that the program is their own. The ability of an educator to create this feeling is an important motivational factor to change.

Attitudes

Change of farmers' attitudes is important in the adoption process. Psychologically, farmers are individuals and as such perceive concepts differently. Psychologically, an attitude may be defined as a tendency to react positively or negatively toward an object. The key ideas in this definition can be expanded as follows:

1. An attitude is directed toward an object e.g. policy, person or event. Farmers have their own attitudes toward change agent and technology involved.

2. An attitude is a positive or negative tendency in relation to an object. It can be extremely favorable, unfavorable, or neutral.

3. An attitude is a tendency to react in a certain way.

Attitude Development

Attitudes and beliefs are formed through learning. In farming communities learning takes place in a social setting. Attitudes are picked through specific experiences. A farmer who loses a crop from his first trial of a new variety may develop a strong negative attitude towards subsequent agricultural innovations.

Attitudes are also developed through communication. For rural communities, it is tied with traditional oral tales and events which are deeply rooted. Institutions within the community affect their attitudes e.g. church groups.

H. Implications

In this chapter some of the problems associated with technology transfer in Kenya were examined. Economic, educational, social, cultural, communication and psychological factors were found to be potential barriers to the transfer of new technologies. These factors must be examined since they have an impact on the policy objectives and programs that are directed towards transformation of the agricultural sector in Kenya.

Chapter V

Summary and Recommendations

A. The Objective and Method

The broad objective of this study was to examine barriers associated with technology transfer and related factors in a wider perspective and with special reference to Kenya. In addition, the role of extension in technology transfer was examined in general and its application to Kenya. More specifically, the objective of the study were: to identify and determine barriers to technology transfer, to examine extension education in relation to technology transfer and to make some recommendations designed to facilitate agricultural technology transfer in Kenya.

The method chosen to accomplish these objectives was through the review of selected available related literature. The introductory chapter indicated that the production of adequate food supplies to meet the demands by the exorbitant population growth in most less developed countries is now a central issue in development. The production of the food requires technological change in farming practices. The first chapter gave brief background to Kenya and its agricultural development in historical perspective from colonial era to the present.

B. Barriers Associated with Technology Transfer

Technology is a scientific method of achieving a practical purpose. Technology transfer involves materials, designs and capacity transfers. Each of these phases is accompanied by dissemination of knowledge and skill required for adoption and use. During the transfer, decision processes are affected by, amongst others, the characteristics of the potential adopters. Selected barriers to technology transfer were reviewed under the following subheadings: economic, educational, social, cultural, communication and psychological.

Economic Barriers

Problems of rural development impinge on economic and socio- cultural fabric of rural communities. Economic factors inhibiting technology transfer and adoption are numerous. This project examined government policy distortions through intervention resulting in direct and indirect effects on primary production. Distortions of incentives to which farmers respond and lack of optimum economic incentive in farming constitutes strong barriers to modernization of agriculture. Price and production controls frequently have adverse effects on efficiency, production and income distribution. In most developing economies, marketing system remain relatively underdeveloped. In addition, unfavorable factor and product price policies instituted by various agencies contribute to barriers of equal strength.

Educational Barriers

Human resources of a nation ultimately determine the character and the pace of its economic and social development. In the larger farming communities, the potential adopters of new innovations are illiterate. For this reason, a country that is unable to develop the skills and knowledge of its people and to utilize them effectively in the national economy is unable to develop anything else. Anyone concerned with the world food problem should be aware that without accelerated education, there is little hope in the world regardless of availability of technology for transfer.

Socio-Cultural Barriers

Social norms, roles, power and rank do create barriers to technology transfer. If an innovation is socially incompatible, it will not be adopted. Social organizations can stimulate or retard technological change. Culture constitutes both material and non-material aspects of a way of life. Values and attitudes in cultural sense are predispositions to perceive, think and feel in relation to scientific innovations. In peasant societies, conservatism appears to be culturally sanctioned, for example, the large amount of time and human energy spent on

rituals, magic, etc. seem to be wasted but where agriculture is a way of life the areas of religion and agriculture are not compartmentalized.

Communication Barriers

Technological change in agriculture involves diffusion process which is a special type of communication. Diffusion is concerned with messages that are perceived by receivers as being new and therefore a degree of risk is present for the receivers and might create a barrier to change. This phenonomenon leads to cautious receiver behavior which also creates a barrier to change. The concept of social change relates to communication processes, the consequence of which at individual and societal level, result in either adoption or rejection of new ideas. People give meanings to things through communication processes.

Psychological Barriers

Since framers live in social settings, socio-psychological factors inherent in group behaviors constitute strong barriers to technological transformations. Although rural communities exist as social systems, each individual builds for himself a system of constructs which he uses to anticipate and control events in his phenomenological world.

There are several psychological characteristics which affect innovation adoption. They include, amongst others, rationality, mental flexibility, dogmatism, orientation towards farming and innovative processes. Motivation as a psychological drive, forces a person to move towards a goal. It is, however, not acquired drive that causes a human being to act, but it is an anxiety state produced by absence of a supposed need.

C. The Role of Extension in Technology Transfer

Technology transfer is an integral part of extension process. There is a wide range of extension teaching methods to choose from depending on a given situation. No matter what method is chosen, the ultimate purpose is to maximize the transfer of scientific information and skills to potential users. To be effective, extension projects should be conducted through a

systematic sequence of actions to promote the diffusion and utilization of agricultural technology.

At least seven cyclical steps are involved in extension program planning: situational analysis, identification of needs, problem determination, coordination, planning learning experience, implementation and evaluation and monitoring. Evaluation is an important phase in extension. It is a stock taking exercise with respect to set goals and objectives. Evaluation searches factors which hinder or favor the achievement of project objectives.

Extension services in Kenya are mainly government responsibilities. There are, however, other agencies and organizations established to serve agriculture.

Technology Transfer in Kenya

Kenya needs food security through an increase and sustenance of primary production to meet the high demand by the population growth. To achieve this, tremendous effort in technological advancement is required. Although technology is available for transfer, extension system frequently encounters numerous barriers to adoption and diffusion of modern farming practices by the farming communities.

Economic disincentives through factor price and marketing distortions exist. The majority of the potential adopters of innovations are illiterate. The social structure of agriculture in Kenya makes farming a way of life, hence, the farm householders relate to complex cognitions, values, beliefs, artifacts and messages which dictate peasant farm management decisions. Cultural taboos maintain stable social structures with slow cultural diffusion which affect change. Language patterns affect the way peasants perceive the world around them. Studies show that behaviors of elites and the mass peasantry create communication barriers leading to relative deprivation among the illiterate masses. Psychological barriers affect motivation and attitude towards work and society. For quicker modernization of agriculture in Kenya, extension personnel must be professionally equipped in solution finding to conquer the barriers to technological change. In addition, a strong coordination between extension service, the institutions e.g. the church is of paramount

importance.

D. Recommendations

1. Agricultural research and extension service should be linked with universities to take advantage of the talents of higher level institutions in generating and analyzing data related to barriers to technological change.

2. Extension program planning should be formulated on the basis of research data about the rural community and farm family.

3. Evaluation studies should be strengthened by use of scientific methods based on standards of rationality with respect to goals and objectives.

4. Bottlenecks to innovation adoption by a target audience should be understood before a program is put into operation.

5. Extension service should be closely linked and coordinated with other agencies e.g. adult education.

6. Extension programs should be carried out through project based policies and proper market function investigations.

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